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Does Particle-Wave Duality within Brain Space Originate from a Recondite Equivalence between Gravitational & Electron Orbit Energy?

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ABSTRACT

The energy within the earth's mass can be calculated to be 10^{-18} J/proton with a quantum equivalence resulting in a frequency of about $1.1 \cdot 10^{15}$ Hz. The comparative frequency for the ground state of the Bohr magneton (atom) is $7.18 \cdot 10^{15}$ Hz. This difference is within the measurement error of 2π. We offer quantitative solutions to suggest manifestations of gravitational and electromagnetic (wave) energies could alternate with each electron orbit (in the order of 10^{-16} s, the time required for a photon to traverse a neuronal cell membrane) resulting in both particle and wave properties. Because the increments of time by which phenomena are measured are much longer, wave-particle "duality" results from the superimposition of characteristics. There are theoretical ramifications, directly relevant to consciousness, for quantitative solutions that relate the gravitational energy between a proton and an electron applied over the standing wavelength of the electromagnetic orbital frequency to the upper limit of the rest mass of the photon. Under optimal conditions one manifestation of gravitational-electromagnetic convergence may occur within molecular structures at concentrations of approximately a femtomole.

Key Words: gravity, electromagnetism, duality, brain space.

1. Introduction

The particle-wave duality of matter is represented throughout the levels of scientific discourse. Every particle (mass) within the brain is associated with a wave propagating through space as described by de Broglie (1962). The action potential can be described as a manifestation of this duality through the expressions of the particulate (chemical) changes and wave (electromagnetic) changes (McFadden, 2002). At the level of the entire brain the duality is reflected in the chemical aggregates that compose the organ and the macroscopic wave function operating on the propagation of the matter field (Eccles, 1992; Jibu and Yasue, 1995).

Consciousness has been suggested to be the consequence of neuroquantum interactions (Bohr, 1958) that involve the coupling of the classical and quantum worlds (Hu and Wu, 2006). Articulating the correspondence between these two worlds might reveal processes by which

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phenomena hereto restricted to the quantum domains could be manifested within the spatial and temporal dimensions of the human brain. Such correspondence might also reveal how the properties of brain function relate to intrinsic universal constants and their quantal connections.

2. Intrinsic Relationships of Universal "Constants"

The convergence of cosmology, metaphysics, and neuroscience is their mutual pursuit of the underlying singular characteristic of reality and the impervious properties of the physical world (Rose, 2006). Fundamental relationships, not affected by the senses and unaltered by different perceptual perspectives, are assumed to define the universe. They are reflected as patterns of relationships and the numerical solutions that associate these patterns. For example gravitational and electromagnetic forces are defined by the product of elements divided by the square of the separating distance times the appropriate universal constant.

The universal constants ultimately reflect the intrinsic space occupied by the mass of the universe that has been estimated empirically to be between 10^{52} kg and 10^{53} kg. The value is also within the same order of magnitude derived by Kolombet (1995) who employed variations of the fine structure value 137 or 1/137 as fundamental units. According to Kolombet 10^{52} kg is the value of 2^{137} multiplied by m_e, the mass of an electron.

The estimated values for the mass of the universe are rationally related to fundamental units and constants. For example, the product of the constants of the three pervasive forces of the universe, u_o (permeability of a vacuum, $4\pi \cdot 10^{-7}$ $N \cdot A^{-2}$), e_o (permittivity of a vacuum, $8.85 \cdot 10^{-12}$ $C^2 \cdot N^{-1} \cdot m^{-2}$ and G (gravitational constant, $6.67 \cdot 10^{-11}$ $N \cdot m^2 \cdot kg^{-2}$) is $74.38 \cdot 10^{-29}$ $m \cdot kg^{-1}$. If this metric is multiplied by the estimated mass of the universe (between 10^{52} kg and 10^{53} kg), the resulting length is about 10^{25} m to 10^{26} m. This is within an order of magnitude of the estimated width of the universe.

3. Macrocosm-Microcosm

The proportions between levels of space and matter may reflect a scale-invariance that could reveal the essential structure and state of reality. As reiterated by many astute thinkers, the ratio of matter within the space occupied within the dimensions of atoms is similar to the space occupied by matter within dimensions of the solar system. Assuming a proton and electron radius of $\sim 10^{-15}$ m the volume occupied by this matter would be about 10^{-44} m^3, assuming a spherical volume. With the classic radius of a hydrogen atom as $37 \cdot 10^{-12}$ m (37 pm) which occupies a spatial volume of about $5 \cdot 10^{-32}$ m^3, the proportion of "space" occupied by matter within this domain would be about 10^{-12} or one part per trillion.

For the solar system most of the mass is within the space occupied by the sun which has a radius of $6.96 \cdot 10^8$ m or $3.43 \cdot 10^{26}$ m^3; Jupiter, the next singular largest volume, is $3.43 \cdot 10^{23}$ m^3, or one thousandths the value. The volume of the solar system is classically $6 \cdot 10^{12}$ m with a volume of $2.16 \cdot 10^{38}$ m^3. The ratio of 10^{26} m^3 to 10^{38} m^3 is 10^{-12} or one part per trillion. We suggest this

convergence of the mass/space ratios (Aharanov and Bohm, 1959) for these two critical levels of discourse through which electromagnetic and gravitational energies are mediated should not be spurious. In fact, the sequence predicts that a comparable proportion should exist for the matter within the space occupied by the galaxy once more accurate measurements are available.

4. Local Energy Density

The Higgs field has been hypothesized to be the process by which matter is manifested between virtual and real existence or in more physical terms as waves or particles (Randall, 2005). We have assumed that the application of the Higgs field to relationships that define interactions of matter within large and small space should result in rational quantitative solutions. In this paper we examine the relationship between the gravitational energy within the sun-earth system and the fundamental proton-electron system.

We assume that if an identity exists between the fundamental operation from which quantum phenomena arise (such as the Bohr magneton) and the macrocosmic representation (the sun-planet system), then intermediate organizations of matter might be more clearly understood. After all, Planck's constant is essentially the energy of the mass-equivalent of an electron moving with fine-structure velocity (1/137 c, the speed of light) following a single rotation around the nucleus.

The product of the sun's mass ($2.0 \cdot 10^{30}$ kg) and earth's mass ($5.98 \cdot 10^{24}$ kg) divided by the square of the radius of the orbit ($1.5 \cdot 10^{11}$ m)^2 is $5.05 \cdot 10^{32}$ kg$^2 \cdot$m^{-2}. When multiplied by the gravitational constant $6.67 \cdot 10^{-11}$ m^{3}k$\cdot$g$^{-1}\cdot$s^{-2} there is $3.37 \cdot 10^{22}$ N of force. When this force is applied over the distance of $1.5 \cdot 10^{11}$ m the resulting energy value is $5.50 \cdot 10^{33}$ J.

If organization and presence of matter are maintained by the Higgs' field, then an energy density should be required to establish the amount of energy/particle. Using the earth's volume ($4/3\pi$ r^3 where r=$6.378 \cdot 10^6$ m) as $1.09 \cdot 10^{21}$ m^3, then the energy density is $5.50 \cdot 10^{33}$ J/$1.09 \cdot 10^{21}$ m^3, or, ~$4.65 \cdot 10^{12}$ J$\cdot$m^{-3}. To discern the numbers of protons and by inference electrons, we divided the average density for the earth $5.52 \cdot 10^3$ kg$\cdot$m^{-3} by the mass of a heaviest most common elementary particle: the proton which is $1.67 \cdot 10^{-27}$ kg. This value is $3.30 \cdot 10^{30}$ protons. Consequently, ($4.65 \cdot 10^{12}$ J$\cdot$m^{-3})/($3.30 \cdot 10^{30}$ protons$\cdot$m^{-3}) results in $1.41 \cdot 10^{-18}$ J per proton.

If there are comparable numbers of electrons, then there is $0.71 \cdot 10^{-18}$ J per particle. The quantum equivalence of this energy is J=hf where h is Planck's constant and f=frequency. The frequency associated with this energy would be ($0.71 \cdot 10^{-18}$ J per electron/$6.63 \cdot 10^{-34}$ J s) or $1.1 \cdot 10^{15}$ Hz.

The frequency associated with the orbiting electron in the Bohr atom is [$9.11 \cdot 10^{-31}$ kg $\cdot$ ($2.34 \cdot 10^6$ ms^{-1}-the fine structure velocity)^2]/$6.63 \cdot 10^{-34}$ J s, or $7.18 \cdot 10^{15}$ Hz. The wavelength is $2.34 \cdot 10^6$ m$\cdot$s^{-1}/$7.18 \cdot 10^{15}$ Hz, or, $0.33 \cdot 10^{-9}$ m. This value, $3.3 \cdot 10^{-10}$ m, is the approximate circumference of the ground state of the Bohr magneton.

5. Periodicity Rather than Particle-Wave Duality

The value of $1.1 \cdot 10^{15}$ Hz as the frequency available from gravitational energy and the value of $7.18 \cdot 10^{15}$ Hz for the numbers of rotations of the ground state electron around the Bohr atom differ within 2% error of 2π (6.28). We suggest this difference in coefficients but equivalence in magnitude is meaningful and not an aleatory value. It would suggest that the energy involved with the gravitational component would be twice (n=2) that of the electrons orbit, or, the electron's orbit would be 1/2 the orbit or wavelength of that derived from the unitary wave (n=1).

This convergence would be consistent with a process by which every orbital completion of the electron is associated with gravitationally-related energy followed by an orbital completion associated with electromagnetic energy within the same space. Such double contribution predicts the electron would display dual properties of either a wave (electromagnetic) or a particle (gravitational) every second orbit. From the perspective of the viewer, who is operating at much longer increments of time, the electron would be able to display both particle and wave properties.

The classical width of an electron in its manifestation as a particle, based upon its impact with matter, is $\sim 2.8 \cdot 10^{-15}$ m. From the perspective of a wave function, if $J=mc^2$, $J=hf$ and $mc^2=h(c/\text{wavelength})$, the wavelength would then be h/mc and would be $6.626 \cdot 10^{-34}$ J s)/($9.109 \cdot 10^{-31}$ kg multiplied by $2.997 \cdot 10^{8}$ m/s or $2.4 \cdot 10^{-12}$ m. This is Compton's well known radius. This results in a difference of almost a 1000 between the predicted width of an electron and the classical observed value.

As calculated elsewhere (Persinger, Koren and Lafreniere, 2008; Persinger and Koren, 2007), one explanation for this discrepancy might be the perceived "relative" length due to the differences in assumed velocity. Assuming the velocity of light as the boundary condition, the discrepancy in velocity required by the Lorenz transform to accommodate this change in length would be in the order of 100 $m \cdot s^{-1}$. The difference in energy equivalence between the conditions associated with the state of the wave and the state of the particle for the electron would be in the order of 10^{-20} J. This value is the amount of energy associated with the neuronal action potential (Persinger, 2010; Wei, 1969), the primary correlate of thinking and its consequences such as observation and measurement (Persinger et al, 2008).

6. Implications

The duality of expression of reality has been embedded in scientific thought for millennia (Rose, 2006). This wave-particle concept is reflected within levels of discourse that range from the mind-body dualism for more than two thousand years of philosophy to the wave-corpuscular dualism of the photon during the last three hundred years of classical physics (Schrödinger, 1978). How we measure our world can yield two solutions, one manifested as mass within space where time is infinite, the other manifested as waves within time where space is infinite.

If the manifestation of effects from "mass" and the manifestation of effects from "waves" are derived from the same source (Aharanov and Bohm, 1959), then the rotational and correlative spin of electrons around protons are the convergent locality for the interaction between these two powerful forces. They are related by small phase-differences in timing that may be as simple as the alternation in expression with each orbital completion.

There are two profound implications. First, for a complete understanding of neuronal function and how electromagnetic fields affect these functions, physical neuroscientists may be required to include parameters that involve relative and "absolute" velocities within frames of reference for the earth within the solar system, the local star group, and even the galaxy. For example Persinger (2006), expanding the remarkable innovations of Jacobson (Jacobson and Yamanashi, 1994), showed that the incorporation of the orbital velocity of the earth into resonance equations for energy (rather than force) was essential to accurately predict the intensity of the magnetic field required to affect a particular molecular mass. The validity of this interaction between mass of the "target" molecule within a specified length by a specific nanoTesla-level intensity magnetic field was recently demonstrated with planarian (Mulligan et al, 2012).

The second implication is that electromagnetic variations could induce subtle effects within the physical organization of matter because of the intrinsic coupling or parity with "gravitational" energies. Planck's constant of $6.62 \cdot 10^{-34}$ J s is equal to the energy equivalence of an electron mass orbiting a proton once. Because the duration of a single rotation of an electron is $1.52 \cdot 10^{-16}$ s, the equivalent energy is $4.36 \cdot 10^{-18}$ J. The wavelength (calculated from c) for this frequency is about $2.34 \cdot 10^{-8}$ m or 23 nm. On the other hand the gravitational force between the electron and a proton for the Bohr atom is $[(1.67 \cdot 10^{-27}$ kg) $\cdot (9.11 \cdot 10^{-31}$ kg) $\cdot (6.67 \cdot 10^{-11}$ $m^3 \cdot kg^{-1} \cdot s^{-2})]/(5.2 \cdot 10^{-11} m)^2$ or $3.74 \cdot 10^{-47}$ N. When applied across the electromagnetic wavelength of $2.34 \cdot 10^{-8}$ m the energy is $8.75 \cdot 10^{-55}$ J. We suggest that this small value has relevance when Kolombet's (1995) argument that 137 is a fundamental application is considered. When multiplied by this value the "gravitational" energy is $1.2 \cdot 10^{-52}$ J. If near rest mass where v approaches unity (1) and $c^2 \rightarrow v$, the mass would be 10^{-52} kg (Persinger, 2012). This is the value from theoretical and empirical inferences to be the upper limit for the rest mass of a photon (Tu et al, 2005).

It may be relevant that the time to produce a quantum of $1.2 \cdot 10^{-20}$ J associated with an axon potential from the persistent $4.36 \cdot 10^{-18}$ J would be in the range of 1 to 3 ms, the functional duration of many action potentials. The latter duration is precisely the temporal threshold of the point durations for optimal analgesic effects, comparable to 4 mg/kg of morphine, in rats from applying complex magnetic fields (Martin et al, 2005). This point duration also corresponds with the predicted time for a proton or electron to expand one Planck's length (Persinger and Koren, 2007). The energies associated with this expansion are assumed to emerge from a third factor (Arahnov and Bohm, 1959) that can be expressed as either electromagnetic or gravitational (King, 2004).

One effect might be to break the symmetry (King, 2004) of alternating expressions of a wave or a particle. If the cancellation or overlap was primarily electromagnetic then the anomalies would be shifted slightly towards the particle ("gravitational") phase or the form of matter. The amount of energy from an average of 10 action potentials per sec from 10^{10} neurons within the human cerebral cortices would be 10^{-9} J. With this amount of energy, a total of 10^{-9} J divided by $6.62 \cdot 10^{-34}$ J per

orbit or about $1.5 \cdot 10^{24}$ separate orbits could be influenced per sec.

If there are $6 \cdot 10^{15}$ orbits per sec in a Bohr atom then a total of $1.5 \cdot 10^{24}$ divided by $6 \cdot 10^{15}$ or about $0.25 \cdot 10^{9}$ molecules could be intercalated or induce to be coherent. This effect would be equivalent to influencing $0.25 \cdot 10^{9}$ molecules divided by $6.023 \cdot 10^{23}$ molecules per mole or about 10^{-15} moles (femtomoles) of a specific chemical configuration. Such values are within the range of concentrations of neuropeptides as well as some very large proteins that behave as enzymes rather than classical neurotransmitters or amino acids. Under optimal conditions this convergence would predict that the interface between gravitational and electromagnetic energies within brain space as well as the primary correlate of consciousness would involve a very low concentration molecule with an as yet unspecified configuration.

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